

## PHYSICS STANDPOINT FOR THE LUMINOSITY REVIEW

This report attempts to review the importance of a luminosity measurement from the point of view of the physics groups, trying to ascertain its urgency relative to the time scales for publication.

There are two methods to measure the luminosity at DØ. The first is the traditional one from the minimum bias events yield as counted from the luminosity monitors. The luminosity is obtained from the measurement of the total  $p\bar{p}$  cross section. This implies a knowledge of the acceptance and the reconstruction efficiency of minimum bias events. The precision of this measurement is limited essentially by the uncertainty on the total  $p\bar{p}$  cross section. The second method relies on the measurement of W and Z boson events cross sections. Once the latter measurement will be limited by the knowledge of the luminosity, comparing W and Z boson rates with the theoretical prediction should provide an improved evaluation of the luminosity. However a precise measurement of the luminosity from the luminosity monitors would provide an essential verification of both the theoretical prediction and the control of systematic uncertainties in the measurement of W and Z boson rates.

Presently the measurement of the luminosity is done assuming the runI cross section, the RunI luminosity monitor acceptance (although the coverage has not dramatically changed the geometrical shape has), and that minimum bias counting is fully efficient.

### *Electroweak Physics Group*

In the electroweak physics group the measurement of luminosity is amongst the highest concerns. On the one hand for the study of the possibility to measure the luminosity with the W and Z processes. On the other, because of the imminence of results such as searches for Z' boson. A first short publication with the data accumulated until the foreseen July 2003 shutdown which should already exceed the RunI Luminosity (need more than 100 pb<sup>-1</sup> of normalizable data) could be submitted by the end of the summer. For this goal a measurement of the luminosity is compulsory.

Although the luminosity could be directly measured from the W and Z rates and the predicted cross section, it would be imprudent to publish any results using such a measurement to normalize a data sample for a future measurements

before the W and Z cross sections are fully published and understood, especially since the infrastructure needed for this luminosity evaluation with streaming is not in place.

It should be noted that the first measurements of the W and Z cross sections for the summer conference of 2002 were in good agreement with the theoretical prediction, resulting in a gain of confidence in the present luminosity measurement.

### *QCD Physics Group*

The QCD working group is presenting at Moriond 2003 a preliminary result on the dijet mass and jet  $p_{\perp}$  cross sections. These are also showing the robustness of the present luminosity evaluation, in particular as different triggers are used with different prescales and show consistent results. The group foresees to publish the dijet mass and if ready the  $p_{\perp}$  cross sections for the summer 2003 provided that a measure of the luminosity is available. Next, will be a measure of the diffractive structure functions. These are normalized to the inelastic cross sections, but need to know the relative trigger efficiencies since diffractive events are triggered with a rapidity gap requiring a veto on the luminosity counters, and are thus in separate exposure groups. The FPD trigger electronics has parts in common with that of the luminosity monitors readout in particular the vertex board, and may thus share a similar fate.

### *Top Physics Group*

In the top physics group the analysis process is somewhat longer. New techniques such as b-tagging are being explored and will require numerous systematic studies. A publication of the top production cross section can not realistically be foreseen anytime before fall 2003. Nevertheless the data sample which will be available before the shutdown in July 2003, should be the one used for the first publication.

### *New Phenomena Group*

The measurement of luminosity is essential for the new phenomena group. The first results that may be published are limits on extra space time dimensions through the di-photon-plus-missing-energy or the search for leptoquarks. To be significant, these results need to be based on a data sample at least as large as that of RunI. Results may be ready for publication as soon as summer 2003. More realistically, publications are likely to be expected for Moriond 2004.

### *Heavy flavour Physics Group*

Among the main topics in the heavy flavour physics group the mixing, lifetime or mass measurements do not heavily rely on the measure of the luminosity, but the B-Jet production cross section does. However for this measurement, numerous systematic studies are required and publications are not expected in the near future.

It appears from the survey of the physics groups activities that the sample of data that has been taken since the summer 2002 and that will be taken until the shutdown in summer 2003 will provide ground for numerous publications which will require a thorough measurement of the luminosity. In summary, from the physics standpoint the measurement of the luminosity should be considered with the highest priority. Two questions still remain to be answered. Despite the read-out electronics not yet being in place is it too late for a thorough measurement of the luminosity in the 2002/2003 data sample? If it were not too late, what are the needs in terms of manpower to complete a simulation of the detector in order to precisely measure the acceptance in time?